Remarks

The Office Action mailed March 30, 2005 has been reviewed and the following remarks have been made in consequence thereof.

Claims 1-13 are now pending in this application. Claims 1-13 are rejected. Claims 1-13 have been amended. No new matter has been added.

The objection to the drawings is respectfully traversed, Applicants have amended the drawings. Accordingly, Applicants respectfully request that the objection to the drawings be withdrawn.

The rejection of Claims 1-13 under 35 U.S.C §112, second paragraph, is respectfully traversed. Applicants have amended Claims 2, 8, 12, 13 and the specification, and respectfully submit that Claims 2, 8, 12, and 13 particularly point out and distinctly claim the subject matter which the Applicants regard as their invention. Accordingly, Applicants respectfully request that the section 112 rejection to Claims 1-13 be withdrawn.

The rejection of Claims 1, 2, 8, 12, and 13 under 35 U.S.C §112, second paragraph, is respectfully traversed. Applicants respectfully traverse the statement on in paragraphs 6A and 6F of the Office Action. Applicants respectfully submit that a first frequency of an RF pre-pulse can be obtained without a need to apply the RF pre-pulse before the first frequency is obtained. Specifically, the specification states in paragraph 21, "At step 204, a first frequency for the RF pre-pulses is obtained by a standard procedure. The procedure involves calculating a transmit frequency for the RF pulses…Once the transmit frequency has been calculated, the first frequency of the RF pre-pulse is calculated based on the difference between the frequencies at which fat and water molecules resonate at the average B_0 magnetic field." The specification further states in paragraph 31, "At step 214, a second frequency of RF pre-pulses is calculated for each scan slice. The calculation of the second frequency of RF pre-pulses for a scan slice is done by using the median value of the B_0 magnetic field over the scan slice and the first frequency of RF pre-pulses.". The specification further states in paragraph 32, "A scan slice is imaged by first applying RF pre-pulses at the second frequency calculated for the scan slice." Accordingly, RF pre-pulses are

applied at the second frequency, which is calculated from the first frequency that is calculated. Hence, a first frequency of an RF pre-pulse can be obtained without a need to apply the RF pre-pulse before the first frequency is obtained. Applicants have amended Claims 1, 2, 8, 12, and 13, and respectfully submit that Claims 1, 2, 8, 12, and 13 particularly point out and distinctly claim the subject matter which the Applicants regard as their invention. Accordingly, Applicants respectfully request that the section 112 rejection of Claims 1, 2, 8, 12, and 13 be withdrawn.

The objection of Claims 1-13 is respectfully traversed. Applicants have amended Claims 1-13. Accordingly, Applicants respectfully request that the objection to Claims 1-13 be withdrawn.

The rejection of Claims 1-13 under 35 U.S.C. § 103(a) as being unpatentable over Yao et al. (U.S. Patent 4,885,542) is respectfully traversed.

Yao et al. describe a method in which as a magnetic field strength drifts to higher values, an object effectively "slides" towards a negative x direction (column 8, lines 27-34). In the method, if a center frequency of an RF transmitter is readjusted or reset at the beginning of each scan, e.g., based upon calibration data taken from the just-preceding scan or from an initial "calibration" measurement cycle, then an actual location of a plurality of slice volumes throughout the scans may be maintained with more accuracy and consistency (column 10, lines 45-52).

Claim 1 recites a method comprising "a. creating a B_0 magnetic field; b. creating a B_0 map for each slice of a scan volume from the B_0 magnetic field, each scan slice having a plurality of positive and negative scan slice pixels; c. obtaining a first frequency of RF pre-pulses for each scan slice; d. calculating a median value of the B_0 magnetic field from the B_0 map for each scan slice; e. calculating percentages of the positive and negative scan slice pixels in each scan slice."

Yao et al. does not describe or suggest a method as recited in Claim 1. Specifically, Yao et al. does not describe or suggest calculating a median value of the B_0 magnetic field from the B_0 map for each scan slice, and calculating percentages of the positive and negative scan slice pixels in each scan slice. Rather, Yao et al. describe effective sliding of an object towards a negative x direction as a magnetic

field strength applied to the object drifts to higher values. Yao et al. further describe maintaining an actual location of a plurality of slice volumes by readjusting a center frequency of an RF transmitter at the beginning of each scan. Yao et al. does not describe or suggest calculating a median or a percentage. Accordingly, Yao et al. does not describe or suggest calculating a median value of the B_0 magnetic field and calculating percentages of the positive and negative scan slice pixels as recited in Claim 1. For the reasons set forth above, Claim 1 is submitted to be patentable over Yao et al.

Claims 4-6 depend from independent Claim 1. When the recitations of Claims 4-6 are considered in combination with the recitations of Claim 1, Applicants submit that dependent Claims 4-6 likewise are patentable over Yao et al.

Claim 2 recites a method comprising the steps of "a. generating a B_0 field map of each scan slice of a scan volume by measuring a B_0 magnetic field over each scan slice of the scan volume, each scan slice having a plurality of positive and negative scan slice pixels; b. obtaining a first frequency of RF pre-pulses; c. calculating a median value of the B_0 magnetic field over each scan slice, the calculation being done using the B_0 field maps; d. calculating percentages of the positive and negative scan slice pixels in each scan slice, the calculation being done using the B_0 field map for each scan slice, wherein a positive scan slice pixel is defined as a scan slice pixel with positive value in the B_0 field map, and wherein a negative scan slice pixel is defined as a scan slice pixel with negative value in the B_0 field map; e. wherein when the percentage of either the positive scan slice pixels or the negative scan slice pixels in each scan slice is greater than a predefined threshold value, performing the step of: i. calculating a second frequency of RF pre-pulses for each scan slice by correcting the first frequency of RF pre-pulses, the correction for a scan slice being done by using the median value of the B_0 magnetic field over the scan slice calculated at step c; otherwise performing: ii. improving shimming of the B_0 magnetic field; and iii. repeating steps a through e; and f. obtaining an MRI image of each scan slice, wherein the MRI image of a scan slice is obtained using RF pre-pulses at the second frequency for the scan slice."

Yao et al. does not describe or suggest a method as recited in Claim 2. Specifically, Yao et al. does not describe or suggest calculating a median value of the

B_0 magnetic field over each scan slice, the calculation being done using the B_0 field maps, calculating percentages of the positive and negative scan slice pixels in each scan slice, the calculation being done using a B_0 field map for each scan slice, where a positive scan slice pixel is defined as a scan slice pixel with positive value in the B_0 field map, and where a negative scan slice pixel is defined as a scan slice pixel with negative value in the B_0 field map, where when the percentage of either the positive scan slice pixels or the negative scan slice pixels in each scan slice is greater than a predefined threshold value, performing the step of calculating a second frequency of RF pre-pulses for each scan slice by correcting the first frequency of RF pre-pulses, the correction for a scan slice being done by using the median value of the B_0 magnetic field over the scan slice calculated at step c, otherwise performing improving shimming of the B_0 magnetic field and repeating steps a through e. Rather, Yao et al. describe effective sliding of an object towards a negative x direction as a magnetic field strength applied to the object drifts to higher values. Yao et al. further describe maintaining an actual location of a plurality of slice volumes by readjusting a center frequency of an RF transmitter at the beginning of each scan. Yao et al. does not describe or suggest calculating a median or a percentage. Accordingly, Yao et al. does not describe or suggest calculating a median value of the B_0 magnetic field, calculating percentages of the positive and negative scan slice pixels, where a positive scan slice pixel is defined as a scan slice pixel with positive value in the B_0 field map and a negative scan slice pixel is defined as a scan slice pixel with negative value in the B_0 field map, when the percentage of either the positive scan slice pixels or the negative scan slice pixels in each scan slice is greater than a predefined threshold value, correcting the first frequency of RF pre-pulses, the correction for a scan slice being done by using the median value of the B_0 magnetic field over the scan slice calculated at step c, and otherwise improving shimming of the B_0 magnetic field and repeating steps a through e. For the reasons set forth above, Claim 2 is submitted to be patentable over Yao et al.

Claims 3 and 7 depend from independent Claim 2. When the recitations of Claims 3 and 7 are considered in combination with the recitations of Claim 2, Applicants submit that dependent Claims 3 and 7 likewise are patentable over Yao et al.

Claim 8 recites a method comprising the steps of "a. generating a B_0 field map of each scan slice of a scan volume by measuring a B_0 magnetic field over each scan slice of the scan volume and storing the B_0 field map in a database, each scan slice having a plurality of positive and negative scan slice pixels; b. obtaining a first frequency of RF pre-pulses for each scan slice; c. calculating median value of the B_0 magnetic field over each scan slice, the calculation being done using the B_0 field maps stored in the database; d. calculating percentages of the positive and negative scan slice pixels in each scan slice, the calculation being done using the B_0 field map for each scan slice, wherein a positive scan slice pixel is defined as a scan slice pixel with positive value in the B_0 field map, and wherein a negative scan slice pixel is defined as a scan slice pixel with negative value in the B_0 field map; e. wherein when the percentage of either the positive scan slice pixels or the negative scan slice pixels in each scan slice is greater than a predefined threshold value, performing the step of: i. calculating a second frequency of RF pre-pulses for each scan slice by correcting the first frequency of RF pre-pulses, the correction for a scan slice being done by adding the median value of the B_0 magnetic field over the scan slice calculated at step c to the first frequency of RF pre-pulses calculated at step b; otherwise performing: ii. improving shimming of the B_0 magnetic field; and iii. repeating steps a through e; f. obtaining an MRI image of each scan slice using RF pre-pulses at second frequency for that scan slice; g. storing the MRI image of each scan slice obtained at step f in the database; and h. displaying the MRI images stored in the database on a display device."

Yao et al. does not describe or suggest a method as recited in Claim 8. Specifically, Yao et al. does not describe or suggest calculating median value of the B_0 magnetic field over each scan slice, the calculation being done using the B_0 field maps stored in the database, calculating percentages of the positive and negative scan slice pixels in each scan slice, the calculation being done using the B_0 field map for each scan slice, where a positive scan slice pixel is defined as a scan slice pixel with positive value in the B_0 field map, and where a negative scan slice pixel is defined as a scan slice pixel with negative value in the B_0 field map, where when the percentage of either the positive scan slice pixels or the negative scan slice pixels in each scan slice is greater than a predefined threshold value, performing the step of calculating a second frequency of RF pre-pulses for each scan slice by correcting the first

frequency of RF pre-pulses, the correction for a scan slice being done by adding the median value of the B_0 magnetic field over the scan slice calculated at step c to the first frequency of RF pre-pulses calculated at step b, otherwise performing improving shimming of the B_0 magnetic field and repeating steps a through e. Rather, Yao et al. describe effective sliding of an object towards a negative x direction as a magnetic field strength applied to the object drifts to higher values. Yao et al. further describe maintaining an actual location of a plurality of slice volumes by readjusting a center frequency of an RF transmitter at the beginning of each scan. Yao et al. does not describe or suggest calculating a median or a percentage. Accordingly, Yao et al. does not describe or suggest calculating median value of the B_0 magnetic field, calculating percentages of the positive and negative scan slice pixels in each scan slice, where a positive scan slice pixel is defined as a scan slice pixel with positive value in the B_0 field map, and where a negative scan slice pixel is defined as a scan slice pixel with negative value in the B_0 field map, where when the percentage of either the positive scan slice pixels or the negative scan slice pixels in each scan slice is greater than a predefined threshold value, calculating a second frequency by correcting the first frequency, the correction for a scan slice being done by adding the median value of the B_0 magnetic field over the scan slice calculated at step c to the first frequency of RF pre-pulses calculated at step b, otherwise improving shimming of the B_0 magnetic field and repeating steps a through e. For the reasons set forth above, Claim 8 is submitted to be patentable over Yao et al.

Claims 9 and 10 depend from independent Claim 8. When the recitations of Claims9 and 10 are considered in combination with the recitations of Claim 8, Applicants submit that dependent Claims 9 and 10 likewise are patentable over Yao et al.

Claim 11 recites an MRI system comprising "a. a polarizing magnet configured to produce a high intensity magnetic field called a B_0 magnetic field; b. a set of shimming coils configured to improve homogeneity of the B_0 magnetic field; c. a magnetic field detector configured to measure a B_0 magnetic field distribution from the B_0 magnetic field; d. a set of gradient coils configured to produce a gradient magnetic field superposed on the B_0 magnetic field; e. a transmitter configured to generate RF pulses and RF pre-pulses wherein frequency of RF pre-pulses is specific

for each scan slice, each scan slice having a plurality of positive and negative scan slice pixels; f. a radio frequency receiver configured to detect magnetic resonance signals; g. a processing module comprising: i.a module configured to calculate the median of the B_0 magnetic field over each scan slice; ii. a module configured to calculate percentages of the positive and negative scan slice pixels in each scan slice, wherein positive scan slice pixels are defined as scan slice pixels with positive B_0 magnetic field values, and wherein negative scan slice pixels are defined as scan slice pixels with negative B_0 magnetic field values; iii. a module configured to calculate a second frequency of RF pre-pulses for each scan slice by adding the median value of the B_0 magnetic field over the scan slice to a first frequency of RF pre-pulses, the first frequency of RF pre-pulses being obtained by a standard procedure; and iv. a module configured to process magnetic resonance signals from a scan slice to obtain an MRI image of each scan slice; and h. a database comprising: i. a storage unit configured to store B_0 field maps; ii. a second storage unit configured to store the median value of the B_0 magnetic field over each scan slice; and iii. a third storage unit configured to store an MRI image of each scan slice."

Yao et al. does not describe or suggest an MRI system as recited in Claim 11. Specifically, Yao et al. does not describe or suggest a processing module including a module configured to calculate the median of the B_0 magnetic field over each scan slice, a module configured to calculate percentages of the positive and negative scan slice pixels in each scan slice, where positive scan slice pixels are defined as scan slice pixels with positive B_0 magnetic field values, and where negative scan slice pixels are defined as scan slice pixels with negative B_0 magnetic field values, a module configured to calculate a second frequency of RF pre-pulses for each scan slice by adding the median value of the B_0 magnetic field over the scan slice to a first frequency of RF pre-pulses, the first frequency of RF pre-pulses being obtained by a standard procedure. Rather, Yao et al. describe effective sliding of an object towards a negative x direction as a magnetic field strength applied to the object drifts to higher values. Yao et al. further describe maintaining an actual location of a plurality of slice volumes by readjusting a center frequency of an RF transmitter at the beginning of each scan. Yao et al. does not describe or suggest calculating a median or a percentage. Accordingly, Yao et al. does not describe or suggest a module configured to calculate the median of the B_0 magnetic field, a module configured to calculate

percentages of the positive and negative scan slice pixels, where positive scan slice pixels are defined as scan slice pixels with positive B_0 magnetic field values, and where negative scan slice pixels are defined as scan slice pixels with negative B_0 magnetic field values, a module configured to calculate a second frequency of RF pre-pulses for each scan slice by adding the median value of the B_0 magnetic field over the scan slice to a first frequency of RF pre-pulses. For the reasons set forth above, Claim 11 is submitted to be patentable over Yao et al.

Claim 12 recites a computer program product for use with a computer, the computer program product comprising a computer usable medium having a computer readable program code embodied therein for generating an image using an MRI system, the computer program code performing the steps of "a. generating a B_0 field map of each scan slice of a scan volume by measuring a B_0 magnetic field over each scan slice of the scan volume, each scan slice having a plurality of positive and negative scan slice pixels; b. obtaining a first frequency of RF pre-pulses; c. calculating median value of the B_0 magnetic field over each scan slice, the calculation being done using the B_0 field maps; d. calculating percentages of the positive and negative scan slice pixels in each scan slice, the calculation being done using the B_0 field map for each scan slice, wherein a positive scan slice pixel is defined as a scan slice pixel with positive value in the B_0 field map, and wherein a negative scan slice pixel is defined as a scan slice pixel with negative value in the B_0 field map; e. wherein when the percentage of either the positive scan slice pixels or the negative scan slice pixels in each scan slice is greater than a predefined threshold value, performing the step of: i. calculating a second frequency of RF pre-pulses for each scan slice by correcting the first frequency of RF pre-pulses, the correction for a scan slice being done by adding the median value of the B_0 magnetic field over the scan slice to the first frequency of RF pre-pulses; otherwise performing: ii. improving shimming of the B_0 magnetic field; and iii. repeating steps a through e; and f. obtaining an MRI image of each scan slice, wherein the MRI image of a scan slice is obtained using RF pre-pulses at the second frequency for the scan slice."

Yao et al. does not describe or suggest a computer program product as recited in Claim 12. Specifically, Yao et al. does not describe or suggest a computer program product calculating median value of the B_0 magnetic field over each scan slice, the

calculation being done using the B_0 field maps, calculating percentages of the positive and negative scan slice pixels in each scan slice, the calculation being done using the B_0 field map for each scan slice, where a positive scan slice pixel is defined as a scan slice pixel with positive value in the B_0 field map, and where a negative scan slice pixel is defined as a scan slice pixel with negative value in the B_0 field map, where when the percentage of either the positive scan slice pixels or the negative scan slice pixels in each scan slice is greater than a predefined threshold value, performing the step of calculating a second frequency of RF pre-pulses for each scan slice by correcting the first frequency of RF pre-pulses, the correction for a scan slice being done by adding the median value of the B_0 magnetic field over the scan slice to the first frequency of RF pre-pulses, otherwise performing improving shimming of the B_0 magnetic field and repeating steps a through e. Rather, Yao et al. describe effective sliding of an object towards a negative x direction as a magnetic field strength applied to the object drifts to higher values. Yao et al. further describe maintaining an actual location of a plurality of slice volumes by readjusting a center frequency of an RF transmitter at the beginning of each scan. Yao et al. does not describe or suggest calculating a median or a percentage. Accordingly, Yao et al. does not describe or suggest calculating median value of the B_0 magnetic field, calculating percentages of the positive and negative scan slice pixels, where a positive scan slice pixel is defined as a scan slice pixel with positive value in the B_0 field map, and where a negative scan slice pixel is defined as a scan slice pixel with negative value in the B_0 field map, where when the percentage of either the positive scan slice pixels or the negative scan slice pixels in each scan slice is greater than a predefined threshold value, calculating a second frequency by correcting the first frequency, the correction for a scan slice being done by adding the median value of the B_0 magnetic field over the scan slice to the first frequency of RF pre-pulses, otherwise improving shimming of the B_0 magnetic field and repeating steps a through e. For the reasons set forth above, Claim 12 is submitted to be patentable over Yao et al.

Claim 13 recites a computer program product for use with a computer, the computer program product comprising a computer usable medium having a computer readable program code embodied therein for acquiring an image using an MRI system, the computer program code performing the steps of "a. generating a B_0 field map of each scan slice of a scan volume by measuring a B_0 magnetic field over each

scan slice of the scan volume and storing the B_0 map in a database, each scan slice having a plurality of positive and negative scan slice pixels; b. obtaining a first frequency of RF pre-pulses for each scan slice; c. calculating median value of the B_0 magnetic field over each scan slice, the calculation being done using the B_0 field maps stored in the database; d. calculating percentages of the positive and negative scan slice pixels in each scan slice, the calculation being done using the B_0 field map for each scan slice, wherein a positive scan slice pixel is defined as a scan slice pixel with positive value in the B_0 field map, and wherein a negative scan slice pixel is defined as a scan slice pixel with negative value in the B_0 field map; e. wherein when the percentage of either the positive scan slice pixels or the negative scan slice pixels in each scan slice is greater than a predefined threshold value, performing the step of: i. calculating a second frequency of RF pre-pulses for each scan slice by correcting the first frequency of RF pre-pulses, the correction for a scan slice being done by adding the median value of the B_0 magnetic field over the scan slice to the first frequency of RF pre-pulses; otherwise performing: ii. improving shimming of the B_0 magnetic field; and repeating steps a through e; f. obtaining an MRI image of each scan slice using RF pre-pulses at second frequency for that scan slice calculated at step e; g. storing the MRI image of each scan slice obtained at step f in the database; and h. displaying the MRI images stored in the database on a display device."

Yao et al. does not describe or suggest a computer program product as recited in Claim 13. Specifically, Yao et al. does not describe or suggest a computer program code calculating median value of the B_0 magnetic field over each scan slice, the calculation being done using the B_0 field maps stored in the database, calculating percentages of the positive and negative scan slice pixels in each scan slice, the calculation being done using the B_0 field map for each scan slice, where a positive scan slice pixel is defined as a scan slice pixel with positive value in the B_0 field map, and where a negative scan slice pixel is defined as a scan slice pixel with negative value in the B_0 field map, where when the percentage of either the positive scan slice pixels or the negative scan slice pixels in each scan slice is greater than a predefined threshold value, calculating a second frequency of RF pre-pulses for each scan slice by correcting the first frequency of RF pre-pulses, the correction for a scan slice being done by adding the median value of the B_0 magnetic field over the scan slice to the first frequency of RF pre-pulses, otherwise improving shimming of the B_0 magnetic

field and repeating steps a through e. Yao et al. further describe maintaining an actual location of a plurality of slice volumes by readjusting a center frequency of an RF transmitter at the beginning of each scan. Yao et al. does not describe or suggest calculating a median or a percentage. Accordingly, Yao et al. does not describe or suggest a computer program code calculating median value of the B_0 magnetic field, calculating percentages of the positive and negative scan slice pixels, where a positive scan slice pixel is defined as a scan slice pixel with positive value in the B_0 field map, and where a negative scan slice pixel is defined as a scan slice pixel with negative value in the B_0 field map, when the percentage of either the positive scan slice pixels or the negative scan slice pixels in each scan slice is greater than a predefined threshold value, calculating a second frequency by correcting the first frequency, the correction for a scan slice being done by adding the median value of the B_0 magnetic field over the scan slice to the first frequency of RF pre-pulses, otherwise improving shimming of the B_0 magnetic field and repeating steps a through e. For the reasons set forth above, Claim 13 is submitted to be patentable over Yao et al.

For at least the reasons set forth above, Applicants respectfully request that the Section 103 rejection of Claims 1-13 be withdrawn.

In addition to the arguments set forth above, Applicants respectfully submit that the Section 103 rejection of Claims 1-13 is not a proper rejection. As is well established, the mere assertion that it would have been obvious to one of ordinary skill in the art to have modified Yao et al. to obtain the claimed recitations of the present invention does not support a prima facie obvious rejection. Rather, each allegation of what would have been an obvious matter of design choice must always be supported by citation to some reference work recognized as standard in the pertinent art and the Applicants given the opportunity to challenge the correctness of the assertion or the notoriety or repute of the cited reference. Applicants have not been provided with the citation to any reference supporting the combination made in the rejection. The rejection, therefore, fails to provide the Applicants with a fair opportunity to respond to the rejection, and fails to provide the Applicants with the opportunity to challenge the correctness of the rejection. Of course, such combinations are impermissible, and for this reason alone, Applicant requests that the Section 103 rejection of Claims 1-13 be withdrawn.

In view of the foregoing amendment and remarks, all the claims now active in this application are believed to be in condition for allowance. Reconsideration and favorable action is respectfully solicited.

Respectfully Submitted,

Patrick W. Rasche
Registration No. 37,916
ARMSTRONG TEASDALE LLP
One Metropolitan Square, Suite 2600
St. Louis, Missouri 63102-2740
(314) 621-5070

IN THE DRAWINGS

Applicant respectfully requests approval of the following drawing changes. Figures 1 and 3 have been amended to clarify the figures and to remove solid black shading areas. Figures 2A, 2B, and 4 have been amended so that the size of reference characters and letters in the figures is at least 32 centimeters. Copy marks have been removed from Figure 4. Applicants submit replacement drawing sheets incorporating the changes to Figures 1-4. No new matter has been added.